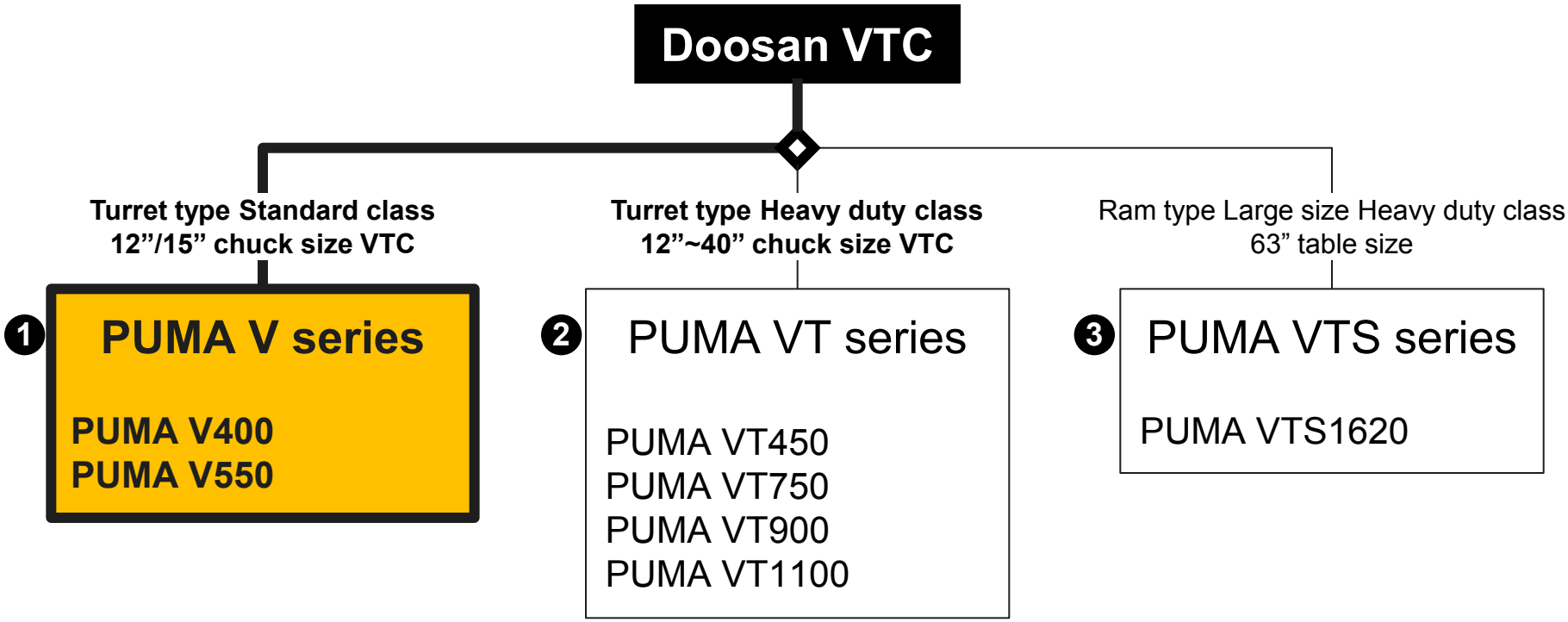
A-2 Vertical TC

	a				b	c
Chuck size (inch)	Small size VTC		Middle size VTC	Large size VTC	Aluminum Wheel turn VTC	Inverted VTC
	PUMA V series	PUMA VT series		PUMA VTS series	PUMA VAW series	PUMA IV series
						
12	V400	VT450				IV3000
15	V550	VT750				
24			VT900			
32			VT1100			
40						
50						
63				VTS1620		
Wheel dia.					VAW700(26”) VAW800(28”)	

a Small/Middle size VTC

Concept…



a-1 PUMA V series

Function

Chuck size

Chuck size (inch)	Max. turning dia. (mm) : 2axis/M	Max. turning length (mm) : 2axis/M	2 axis			M		
			Left	Right	2 spindle	Left	Right	2 spindle
12	496/420	461/400	**PUMA V400L**	**PUMA V400R**	**PUMA V400-2SP**	**PUMA V400ML**	**PUMA V400MR**	
	450	450	PUMA VT450L	PUMA VT450R	PUMA VT450-2SP	PUMA VT450ML	PUMA VT450MR	PUMA VT450M-2SP
15	730/800	750	**PUMA V550L**	**PUMA V550R**	**PUMA V550-2SP**	**PUMA V550ML**		
	750	760	PUMA VT750L	PUMA VT750R	PUMA VT750-2SP	PUMA VT750ML	PUMA VT750MR	PUMA VT750M-2SP
24	900	850	PUMA VT900L	PUMA VT900R	PUMA VT900-2SP	PUMA VT900ML	PUMA VT900MR	PUMA VT900M-2SP
32	1100	1000		PUMA VT1100			PUMA VT1100M	
40								
50								
63	2000	1556		PUMA VTS1620			PUMA VTS1620M	

PUMA V series

Standard VTC for high productivity and heavy duty machining

Sales points…

① Steady seller of Doosan Vertical Turning Center for various industries
- PUMA V series sold above 250 units/year over 10 years

PUMA V400 and 2-SP

PUMA V550 and 2-SP

		PUMA V400	PUMA V550
Chuck size		12 inch	15 inch
Max. Turning Dia.		496 (2-axis) / 420 mm (M*)	730 (2-axis) / 800 mm (M*)
Max. Turning length		461 (2-axis) / 400 mm (M*)	750 mm
Travel (X/Z)		268 / 468 mm	390 (M*: 490) / 780 mm
Rapid Traverse (X/Z)		20 / 20 m/min	20 (M*: 12) / 16 m/min
Spindle Speed / Power	Main	3000 r/min, 22/18.5kW	2000 r/min, 37/30 kW (w/ Gear Box)
	Milling*	4000 r/min, 5.5kW	3000 r/min, 11kW
No. of Tool Stations		12 stations	8 (2-axis) /12 (M)*stations

* Milling Model

New

OPTION_SERVO STRADDLE TOOL (PUMA V400)

What is Straddle Tool?

1 Special Tool designed to machine both upper and bottom faces at the same time.
2 Mainly used to machine Brake Disc of Automobile.

Machining Width / **Adjusting range for the thickness of workpieces**
①　②

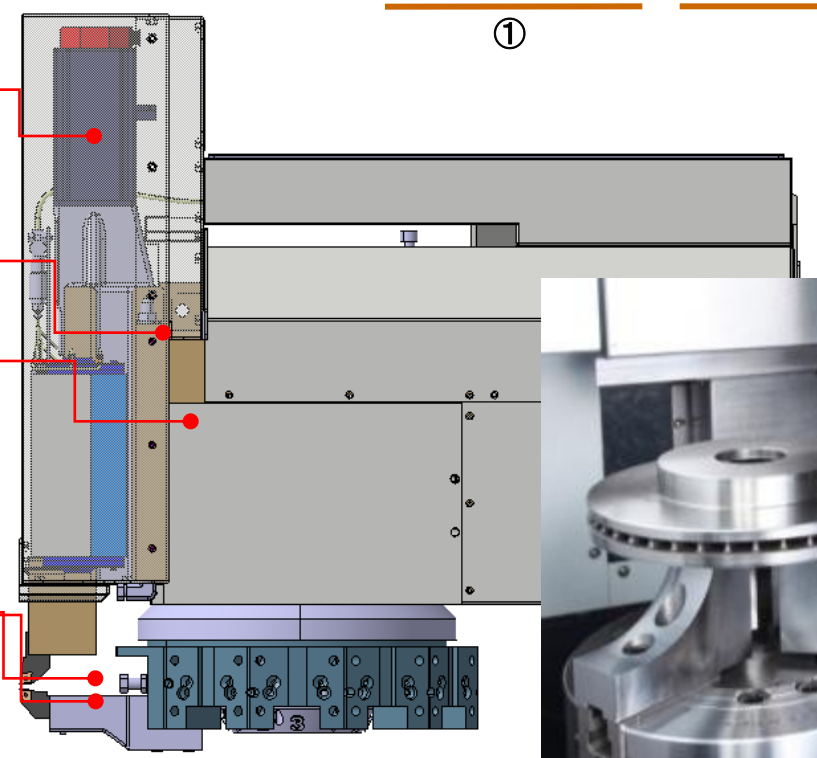
◆ SERVO MOTOR

◆ BOX GUIDE WAY

◆ BALL SCREW

◆ Machining Width
- 5~50 mm

◆ Machining length
- 120 mm



Example)
120 mm / 6 ~ 50 mm
①　②

Video #1 PUMA V400 SERVO STRADDLE TOOL

PUMA V400 with LM Guide Way: Launching ’14.04 ~

- For mass production of automobile disk parts, high precision/high Rigidity Roller Type LM guide way is adopted additionally.

- Why LM Guide Way? (From Customer Voice)
  1) It is possible to increase to cycle time
     - how? Increase acceleration/deceleration
  2) Easy maintenance

- Competitors
  1) BOX way: OKUMA
  2) LM Guide way: WIA, HWACHEON, YOU JI

MACHINING EXAMPLE_DRUM

System Solutions

PUMA V400, PUMA V400M, ROBOT

Item **DRUM-BRAKE, REAR**

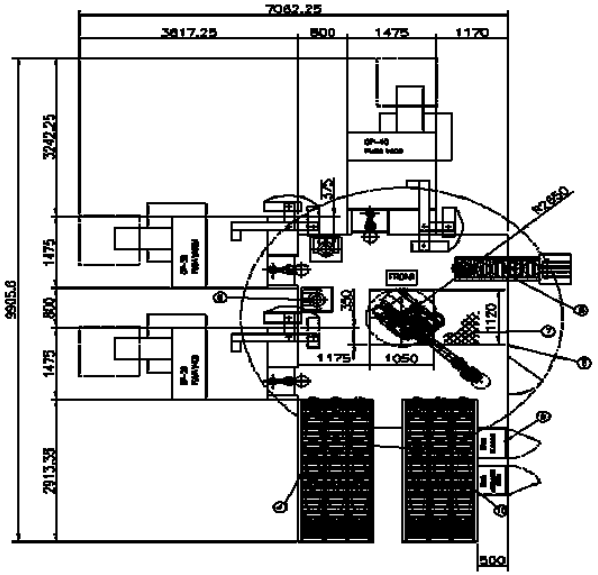
Production Volume

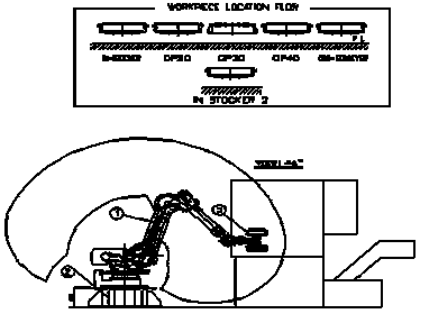
210,000 EA/ Year

Key Technology

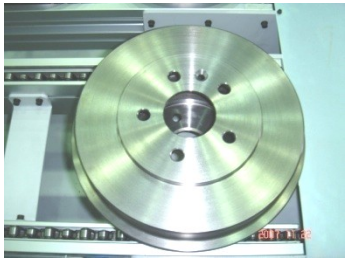
Composite Tool (Drill & Back Chamfer)

Layout



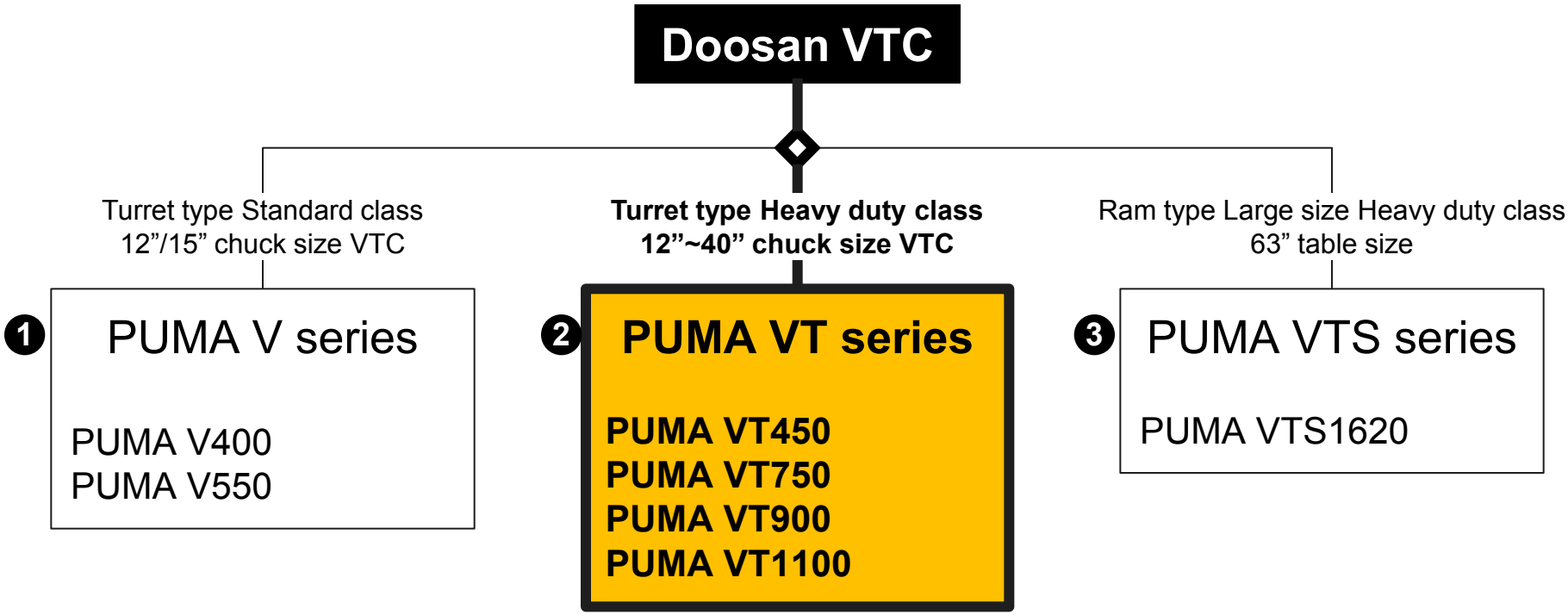


Before *After*



a Small/Middle size VTC

Concept…



a-2 PUMA VT series

Function

Chuck size

Chuck size (inch)	Max. turning dia. (mm) : 2axis/M	Max. turning length (mm) : 2axis/M	2 axis			M		
			Left	Right	2 spindle	Left	Right	2 spindle
12	496/420	461/400	PUMA V400L	PUMA V400R	PUMA V400-2SP	PUMA V400ML	PUMA V400MR	
	450	450	**PUMA VT450L**	**PUMA VT450R**	**PUMA VT450-2SP**	**PUMA VT450ML**	**PUMA VT450MR**	**PUMA VT450M-2SP**
15	730/800	750	PUMA V550L	PUMA V550R	PUMA V550-2SP	PUMA V550ML		
	750	760	**PUMA VT750L**	**PUMA VT750R**	**PUMA VT750-2SP**	**PUMA VT750ML**	**PUMA VT750MR**	**PUMA VT750M-2SP**
24	900	850	**PUMA VT900L**	**PUMA VT900R**	**PUMA VT900-2SP**	**PUMA VT900ML**	**PUMA VT900MR**	**PUMA VT900M-2SP**
32	1100	1000		**PUMA VT1100**			**PUMA VT1100M**	
40								
50								
63	2000	1556		PUMA VTS1620			PUMA VTS1620M	

High performance VTC for heavy duty machining up to 32 inch chuck

Small size

PUMA VT450

1) Chuck Size	**: 12 inch**
2) Max. turning dia.	: 450 mm
3) Max. turning length	: 450 mm
4) Spindle speed	: 2,500 r/min
5) Spindle Power	: 22/18.5 kW
6) Travels (X/Z)	: 240/450 mm
7) Rapid (X/Z)	: 24/24 m/min
8) No. of tool stations	: 12

PUMA VT750

1) Chuck Size	**: 15 inch**
2) Max. turning dia.	: 750 mm
3) Max. turning length	: 760 mm
4) Spindle speed	: 2,000 r/min
5) Spindle Power	: 30/22 kW
6) Travels (X/Z)	: 385/760 mm
7) Rapid (X/Z)	: 20/20 m/min
8) No. of tool stations	: 12

Middle size

PUMA VT900

1) Chuck Size	**: 24 inch**
2) Max. turning dia.	: 900 mm
3) Max. turning length	: 850 mm
4) Spindle speed	: 1,800 r/min
5) Spindle Power	: 45/37 kW
6) Travels (X/Z)	: 470/850 mm
7) Rapid (X/Z)	: 20/20 m/min
8) No. of tool stations	: 12

PUMA VT1100

1) Chuck Size	**: 32 inch**
2) Max. turning dia.	: 1100 mm
3) Max. turning length	: 1000 mm
4) Spindle speed	: 850 r/min
5) Spindle Power	: 60/45 kW
6) Travels (X/Z)	: 580/1000 mm
7) Rapid (X/Z)	: 20/20 m/min
8) No. of tool stations	: 12

LINE-UP COMPARISON with COMPETITORS

Maker	12”	18”	24”	32”
OKUMA	V400	V600	V800	V100R
	2-axis 3-axis 2-spindle	2-axis 3-axis 2-spindle	2-axis 3-axis 2-spindle	2-axis 3-axis 2-spindle
YOU-JI	YV-320	YV-600	YV-800	YV-1000
	2-axis 3-axis	2-axis 3-axis	2-axis 3-axis	2-axis 3-axis ATC
DOOSAN	PUMA V400 PUMA VT450	PUMA V550 PUMA VT750	PUMA VT900	PUMA VT1100
	2-axis 3-axis 2-spindle	2-axis 3-axis 2-spindle	2-axis 3-axis 2-spindle	2-axis 3-axis

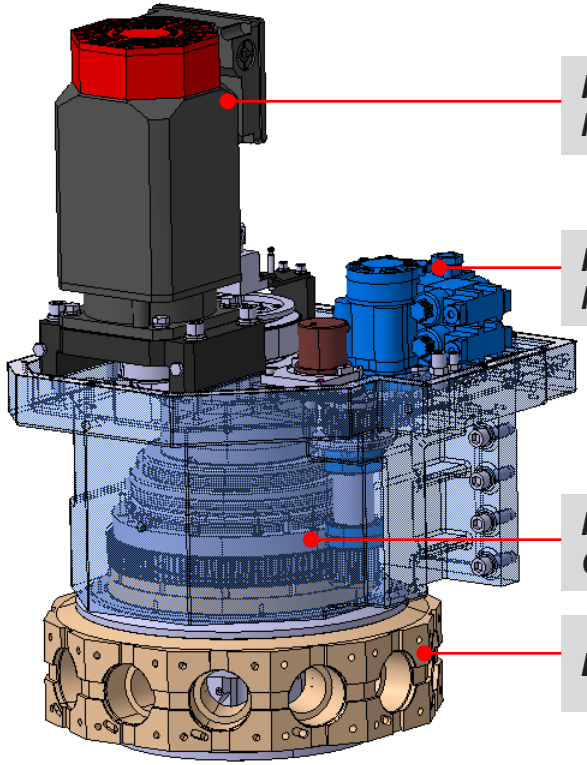
V Series

YV Series

VT Series

APPLYING 2-MOTOR TURRET_PUMA VT900M

To improve milling capability, 2-Motor (Milling Motor and Turret Index Motor) turret is applied to PUMA VT900M.



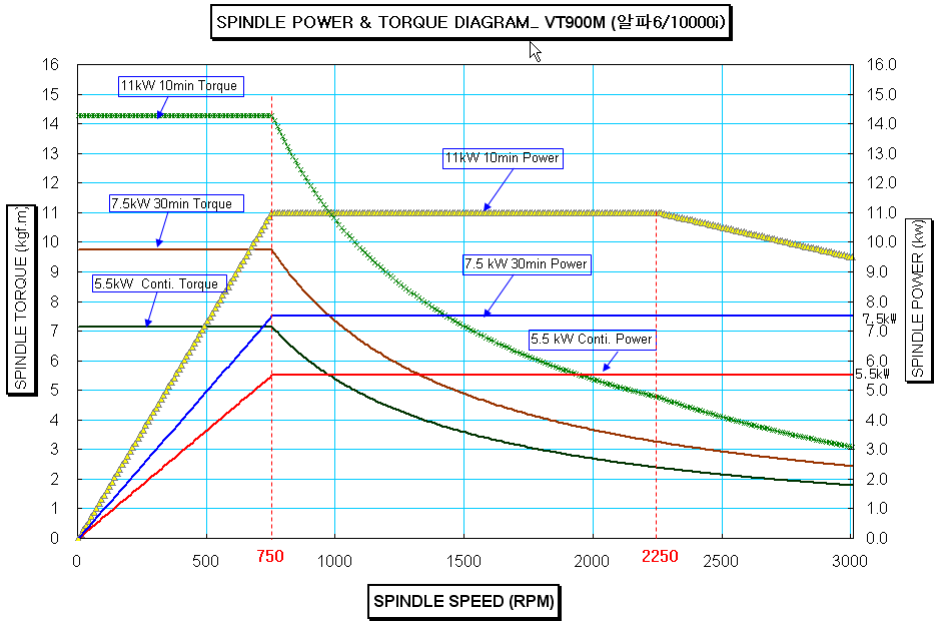
High Power Milling Motor(11/7.5/5.5Kw)

(M30XP3.5)

Powerful HYD Index Motor

High rigidity Curvic-Coupling

BMT85 Tool Drive

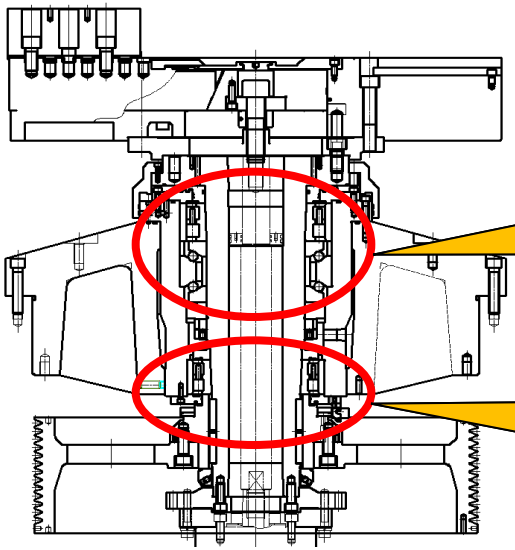


IMPROVING RIGIDITY of PUMA VT1100M SPINDLE

Increased Front & Rear Spindle Bearings' size for the Rigidity of Spindle.

Chuck Size, Machining Range and Other Things are same with the Specification of the Current VT1100 Model (Mass Production from 2014.01)

PUMA VT1100 PUMA VT1100M		Chuck Size	Chuck Adapter	Front Bearing (Upper, mm)		Rear Bearing (Lower, mm)		Spindle Nose
				Inner	Outer	Inner	Outer	
Previous	Standard	32"	X	Φ200	Φ310	Φ180	Φ280	ISO 702-4 NO.15 (Φ380mm)
	Option	40"	O					
Upgrade	**Standard**	**32"**	**X**	**Φ240**	**Φ360**	**Φ220**	**Φ340**	
	Option	**40"**	**O**					



- **Front Spindle Bearing**
- **Rear Spindle Bearing**

Max. allowable workpiece weight including chuck

2000kg ➔ 3000kg

PUMA VT1100M

- **Demo Item**

  Housing

- **Material**

  SM45C (D800 x 300L)

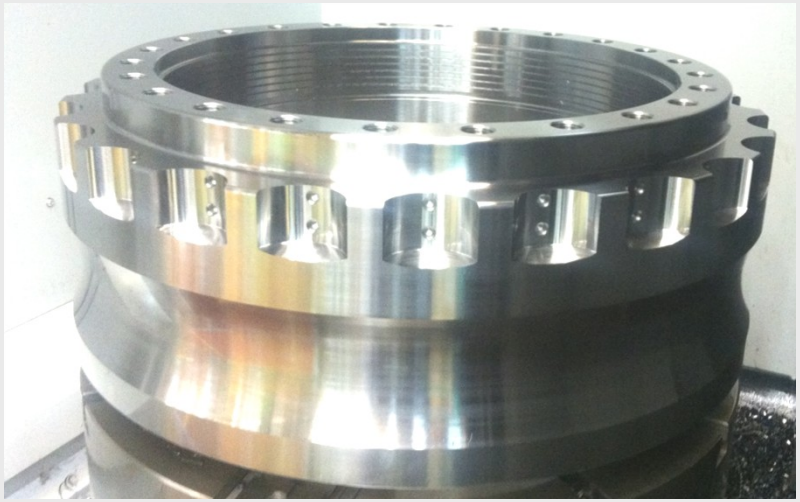
- **Cutting Condition**

  Φ80 Plunge mill

  - Spindle speed : 1200 r/min
  - Feedrate : 500 mm/min

  M30 TAP

  - Spindle speed : 160 r/min
  - Feedrate : 3.5 mm/rev



MACHINING EXAMPLE_FLY WHEEL

System Solutions

VT450T, TC400

Item **Fly wheel**

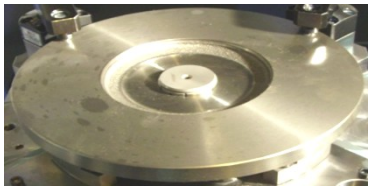
Production Volume

108,000 EA/ Year

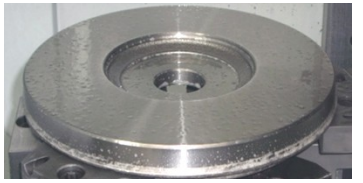
Key Technology

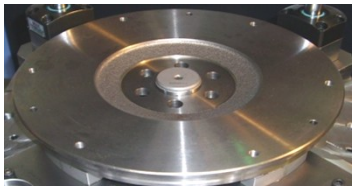
Special Chuck & Fixture

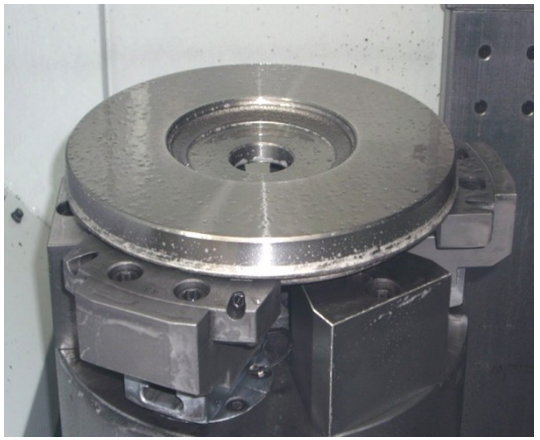
Before

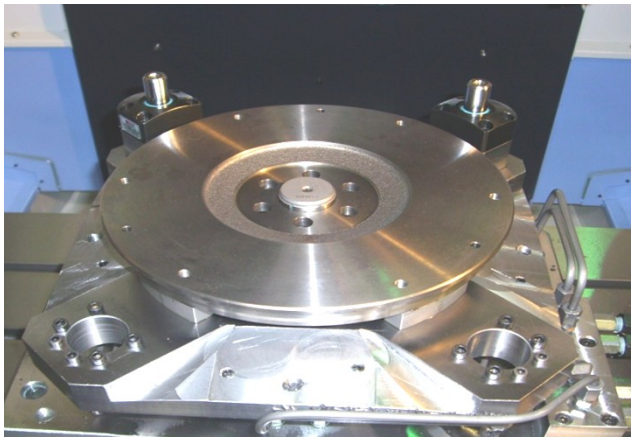


After







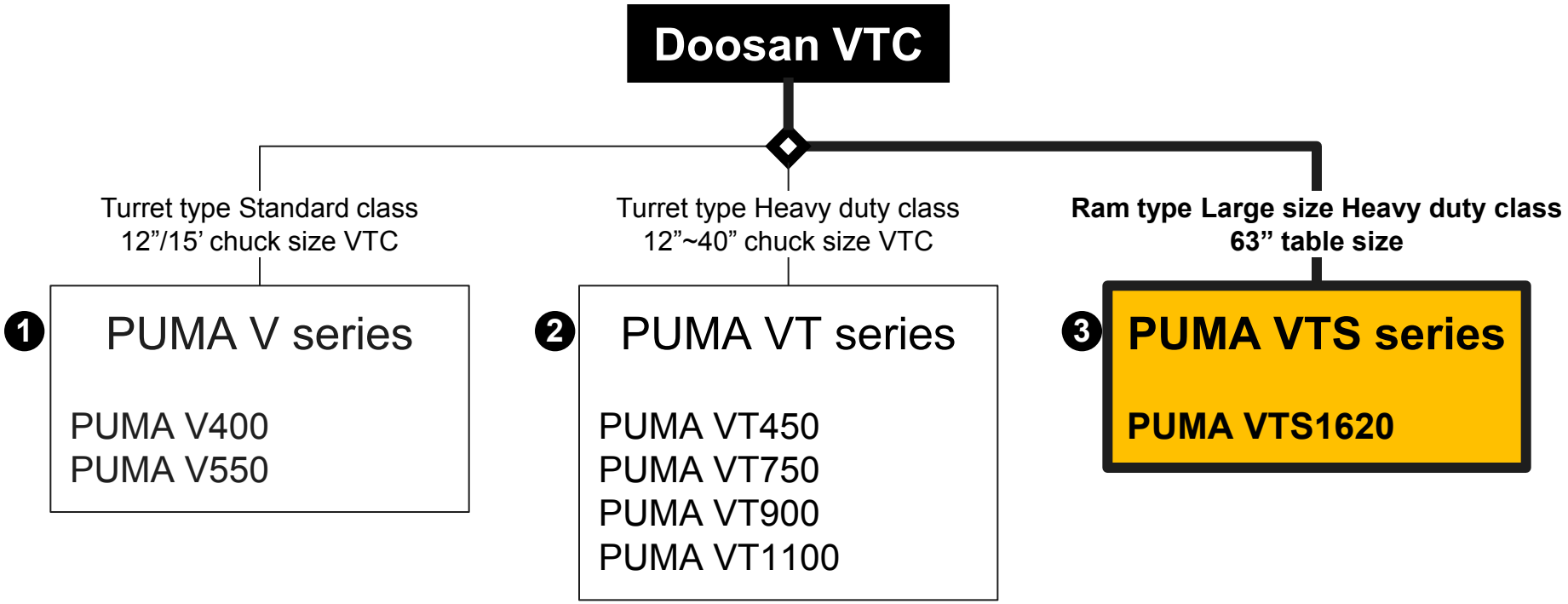


A-2 Vertical TC

	a				b	c
Chuck size (inch)	Small size VTC		Middle size VTC	Large size VTC	Aluminum Wheel turn VTC	Inverted VTC
	PUMA V series	PUMA VT series		PUMA VTS series	PUMA VAW series	PUMA IV series
						
12	V400	VT450				IV3000
15	V550	VT750				
24			VT900			
32			VT1100			
40						
50						
63				VTS1620		
Wheel dia.					VAW700(26”) VAW800(28”)	

a Large size VTC

Concept…



a-3 PUMA VTS series

Function →

Chuck size ↓

Chuck size (inch)	Max. turning dia. (mm) : 2axis/M	Max. turning length (mm) : 2axis/M	2 axis			M		
			Left	Right	2 spindle	Left	Right	2 spindle
12	496/420	461/400	PUMA V400L	PUMA V400R	PUMA V400-2SP	PUMA V400ML	PUMA V400MR	
	450	450	PUMA VT450L	PUMA VT450R	PUMA VT450-2SP	PUMA VT450ML	PUMA VT450MR	PUMA VT450M-2SP
15	730/800	750	PUMA V550L	PUMA V550R	PUMA V550-2SP	PUMA V550ML		
	750	760	PUMA VT750L	PUMA VT750R	PUMA VT750-2SP	PUMA VT750ML	PUMA VT750MR	PUMA VT750M-2SP
24	900	850	PUMA VT900L	PUMA VT900R	PUMA VT900-2SP	PUMA VT900ML	PUMA VT900MR	PUMA VT900M-2SP
32	1100	1000		PUMA VT1100			PUMA VT1100M	
40								
50								
63	2000	1556		**PUMA VTS1620**			**PUMA VTS1620M**	

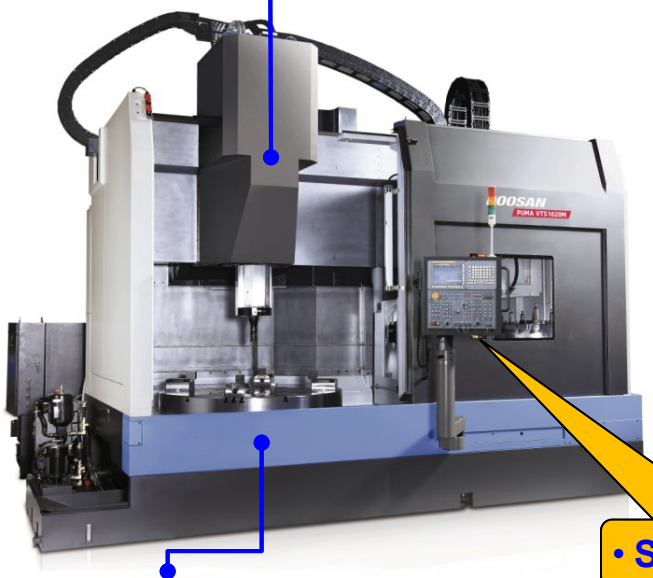
Ultra heavy duty machining and excellent productivity for large workpiece

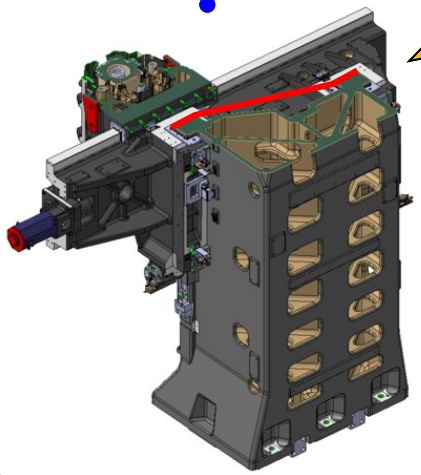
PUMA VTS1620

[Major Specification]

1) Chuck Size	**: 63 inch**
2) Max. turning dia.	: 2000 mm
3) Max. turning height	: 1556 mm
4) Spindle speed	: 250 r/min
5) Spindle Power (30min./Cont.)	: 45/37.5 kW
6) Travels (X/Z)	: -127~1600 mm / 960 mm
7) Guideway Type	: BOX GUIDE WAY
8) ATC (Std./Opt.)	: 18 / 24 ea

Large size Heavy duty VTC with Ram spindle & Φ1600mm chuck

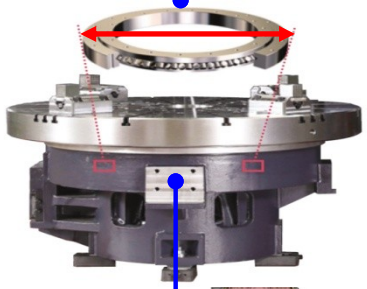


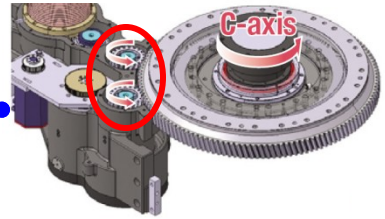


- Applied single step column with powerful triangular rib and wide span between box guideways for heavy duty turning
- Globally popular structure

- **Siemens 828D**

- **Automatic Pallet Changer (Opt.)**
  - **Chuck Size : Φ1200 / Φ1400 / Φ1600mm**
  - **Max. loading Weight : 5 ton(Including chuck)**
  - **Manual chuck(Hydraulic chuck is not available)**



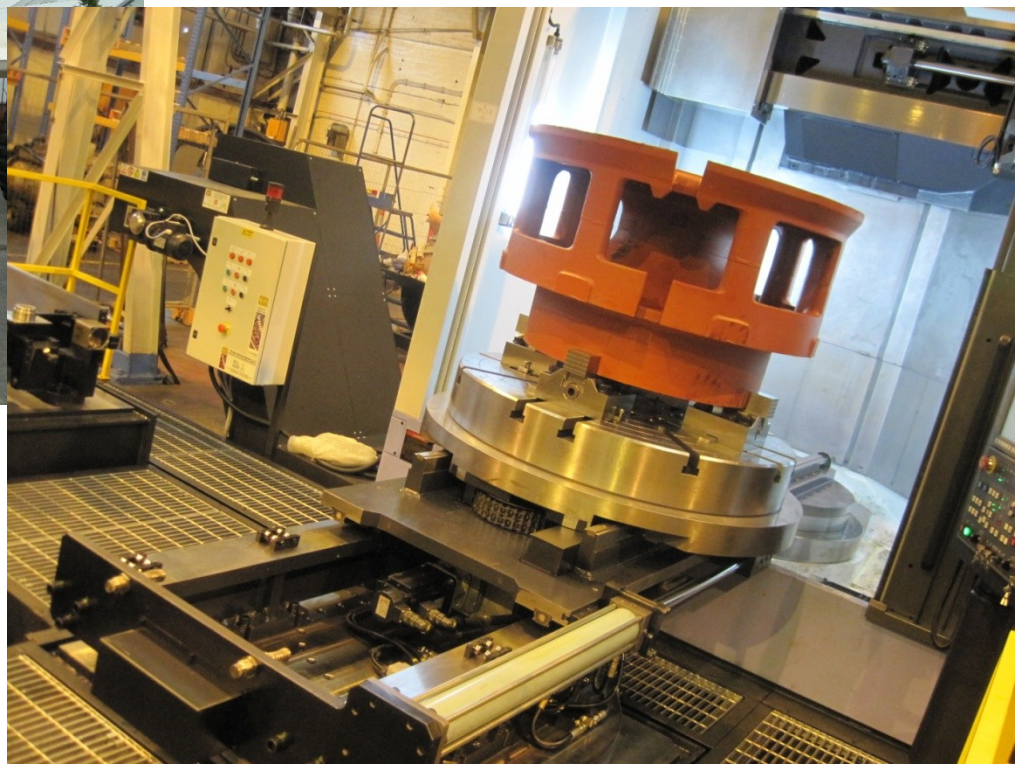


- Applied 2-Step Powerful gear drive and large size spindle bearing for heavy duty turning
- Twin Helical Gear Backlash Free System (Patent) for High accuracy of C axis

[Example] TEREX(Customer)_Wheel

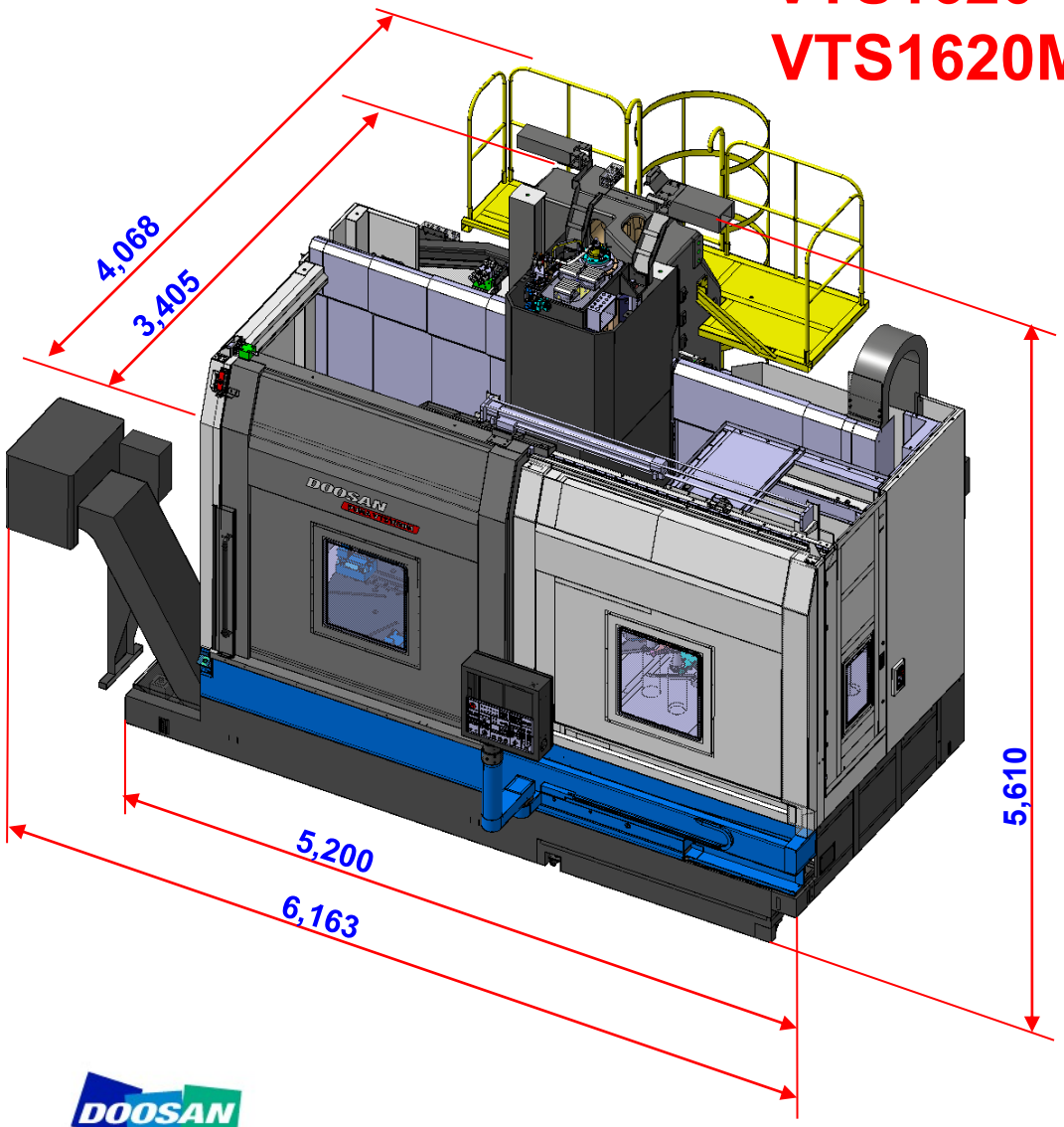
Video#1 VTS APC (8 times faster than real)

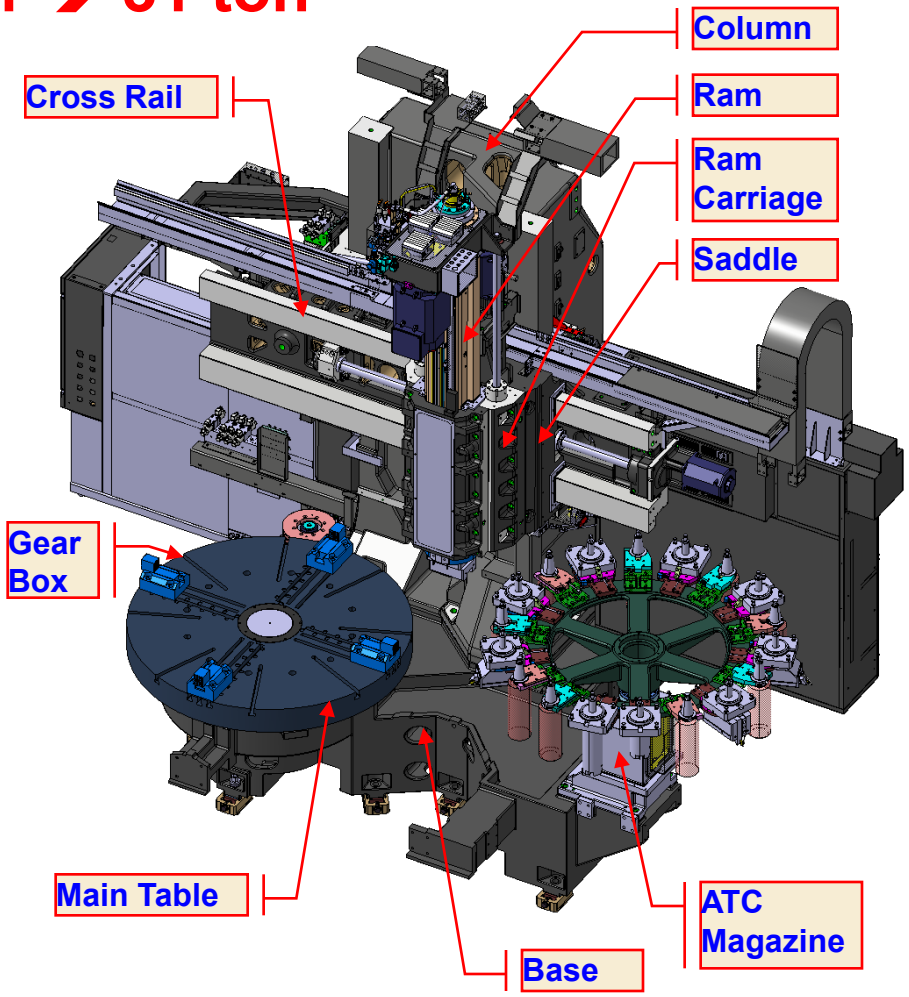
Video#2 VTS APC (TEREX Example_Real Time)



MACHINE SIZE and STRUCTURE of PUMA VTS1620/M

VTS1620 ➔ 30 ton
VTS1620M ➔ 31 ton





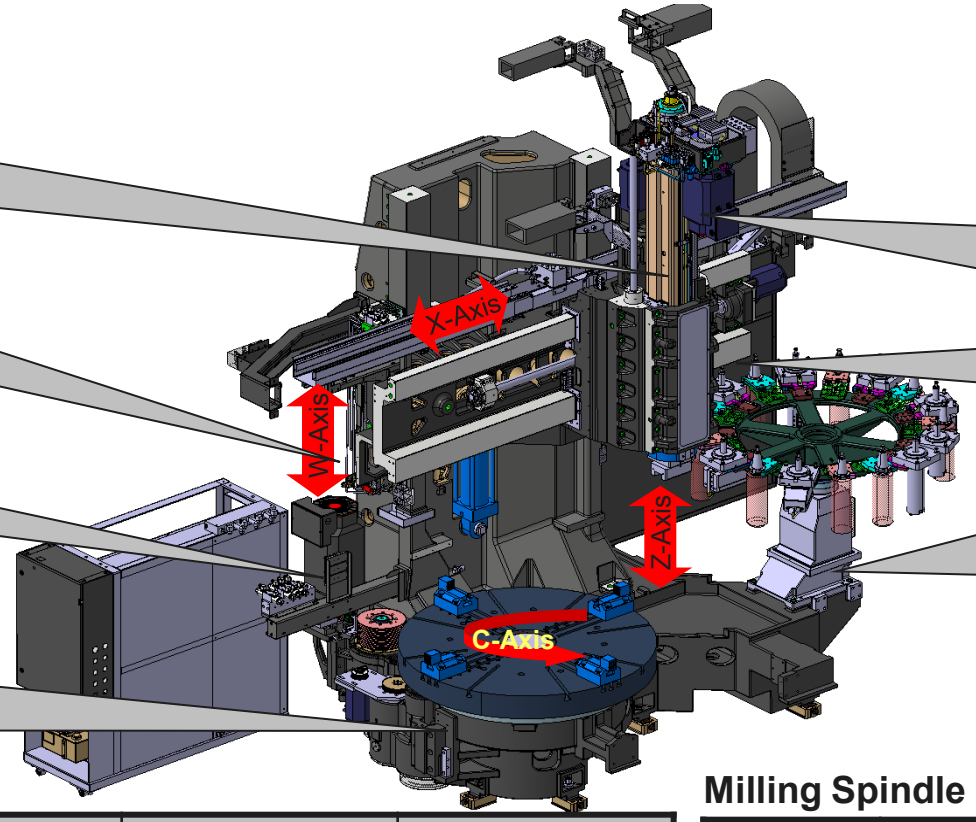
MAJOR SPECIFICATION_PUMA VTS1620/M

Ram (Z-axis)
Stroke : 960 mm
Speed : 12 m/min
Force : 31,100 N
Dual Hydraulic Balance

Cross Rail Elevation (W-axis)
200mm×4 Step
= 800 mm
Hydraulic Cylinder Drive

TABLE Motor
➔ 45/37kW (60kW Option)
C-axis Servo Motor ➔ 4.0kW

Main Table : 63 inch (1,600mm)
Max. Torque : 19,875 Nm
Max. Speed : 250 r/min
Max. Load Weight : 10 ton
C-Axis Speed : 900 deg/min



Rotary tool spindle
Standard (18.5/15kW)
➔ 3,000r/min (275Nm)
Option (15/11 kW)
➔ 2,000 r/min (687Nm)

Cross Rail (X-axis)
Stroke : 1,727 mm
Speed : 12m/min
Force : 24,880 N

Standard Magazine : 18 Tools
Turning tool clamping : 6.5 ton
(A2-8 with 2-Key)
Rotary tool clamping: 2.5 ton
(BT50, ISO No.50)

Main Table Power

Maker	Power	Torque	Speed
Doosan	37/45 kW(Std.), 55/60 kW(Opt.)	19,875 Nm, 24,380 Nm	250 r/min
Youji	37/45 kW	19,677 Nm	250 r/min
Toshiba	37/45 kW	20,930 Nm	400 r/min
Giddings Lews	55/75 kW	24,550 Nm	450 r/min
HNK	37/45 kW	20,628 Nm	280 r/min
Hankook	37/45 kW	23,800 Nm	250 r/min
OM	45/55 kW, 30/37 kW	20,000 Nm	320 r/min, 250 r/min

Milling Spindle Power

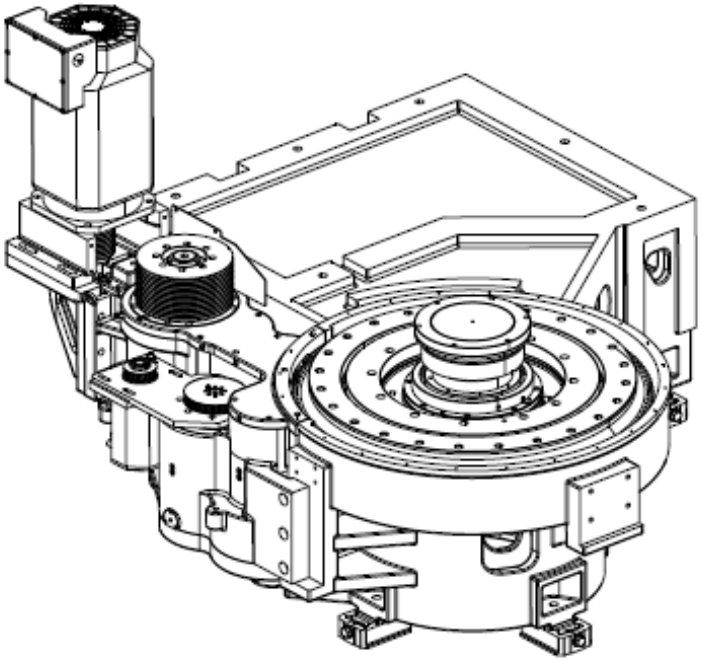
Maker	Power	Torque	Speed
Doosan	Std. 18.5/15 kW	262 Nm	3,000 r/min
	Opt. 15/11 kW	687 Nm	2,000 r/min
Youji	7.5/11 kW	350 Nm	2,400 r/min
Toshiba	15/18.5 kW	233 Nm	3,000 r/min
HNK	15/18.5 kW	440 Nm	1,500 r/min
OM	11/15 kW	280 Nm	2,500 r/min
Hankook	15/18.5 kW	440 Nm	1,500 r/min

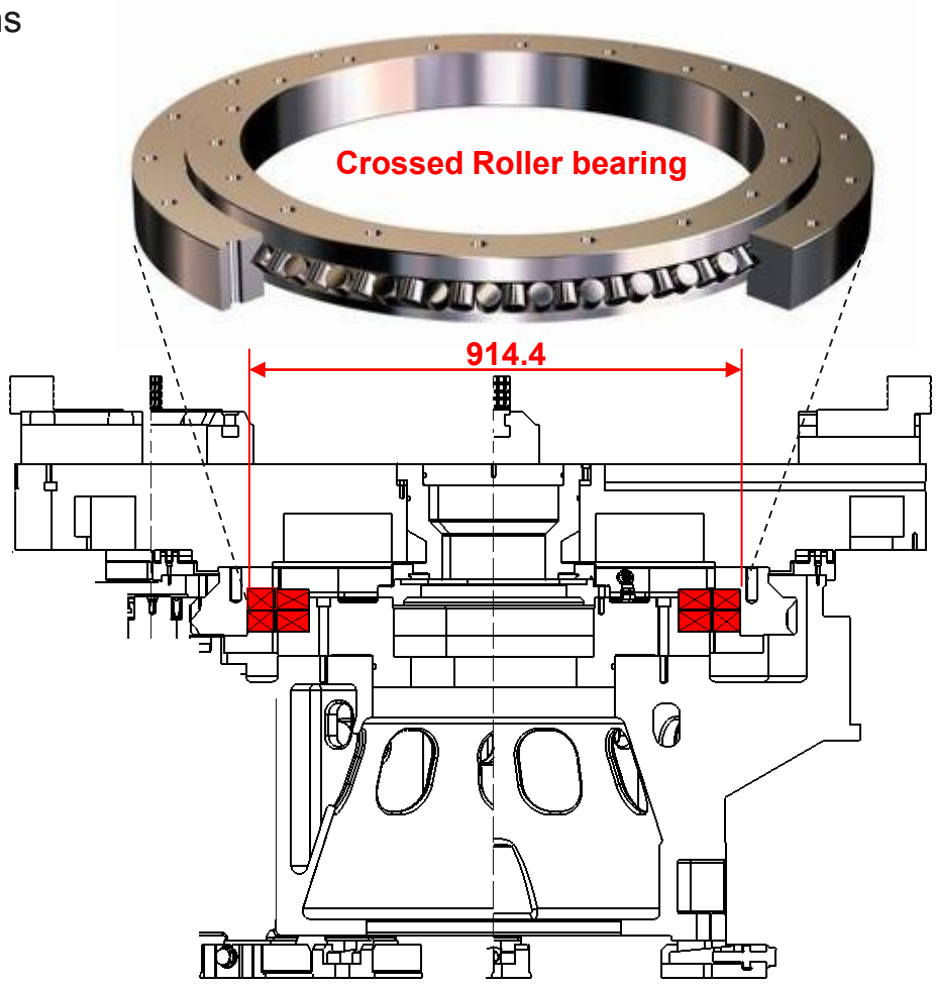
ROBUST TABLE_PUMA VTS1620/M

For heavy duty machining, tapered cross roller bearing (dia. 914.4 mm) is applied the table construction.

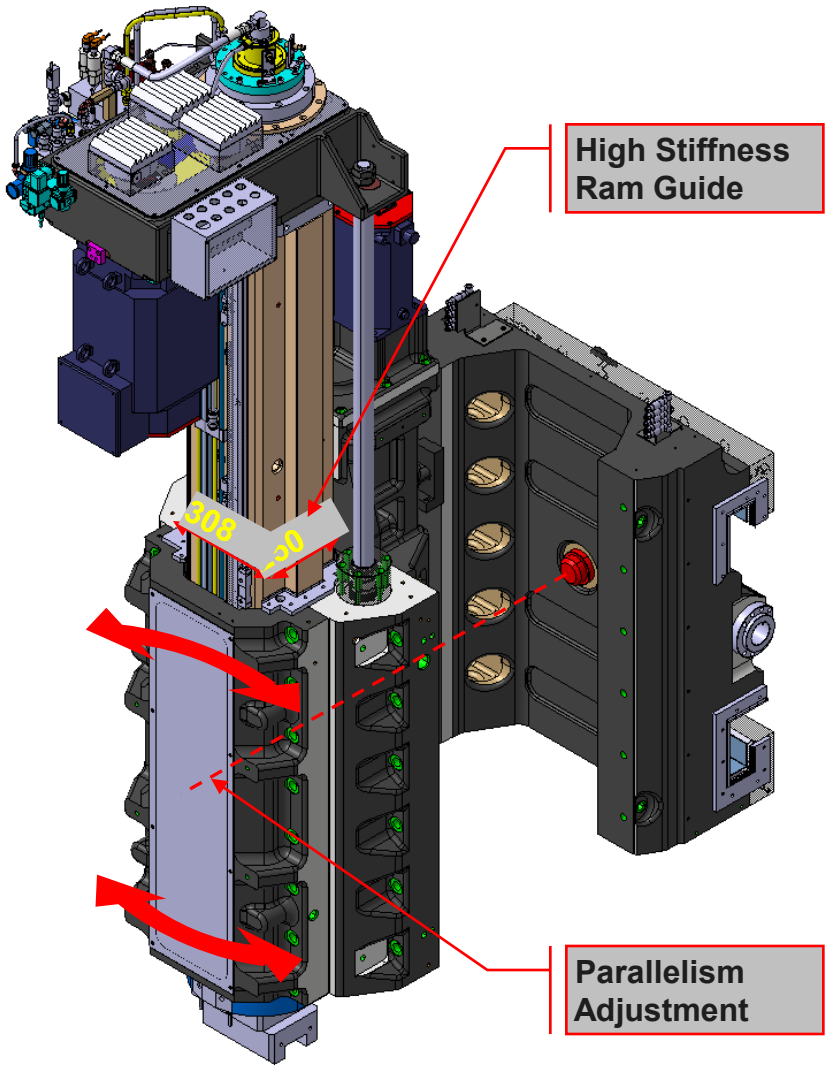
Advantages of cross roller bearing

1)The bearing supports both radial and axial directions
2)Very rigid with high running accuracy



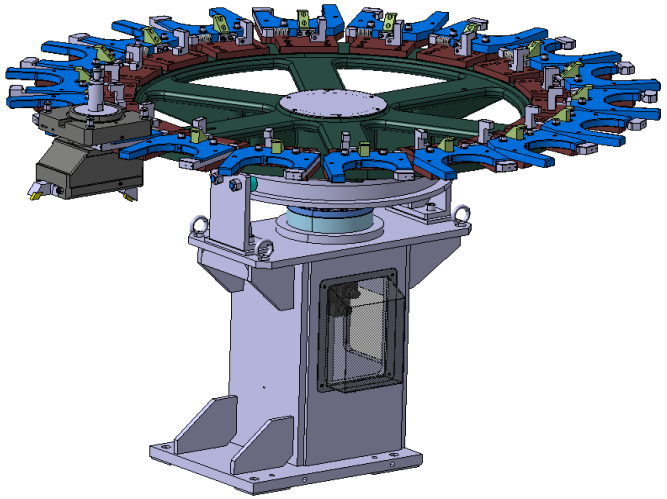


HIGH RIGIDITY RAM STRUCTURE_PUMA VTS1620/M



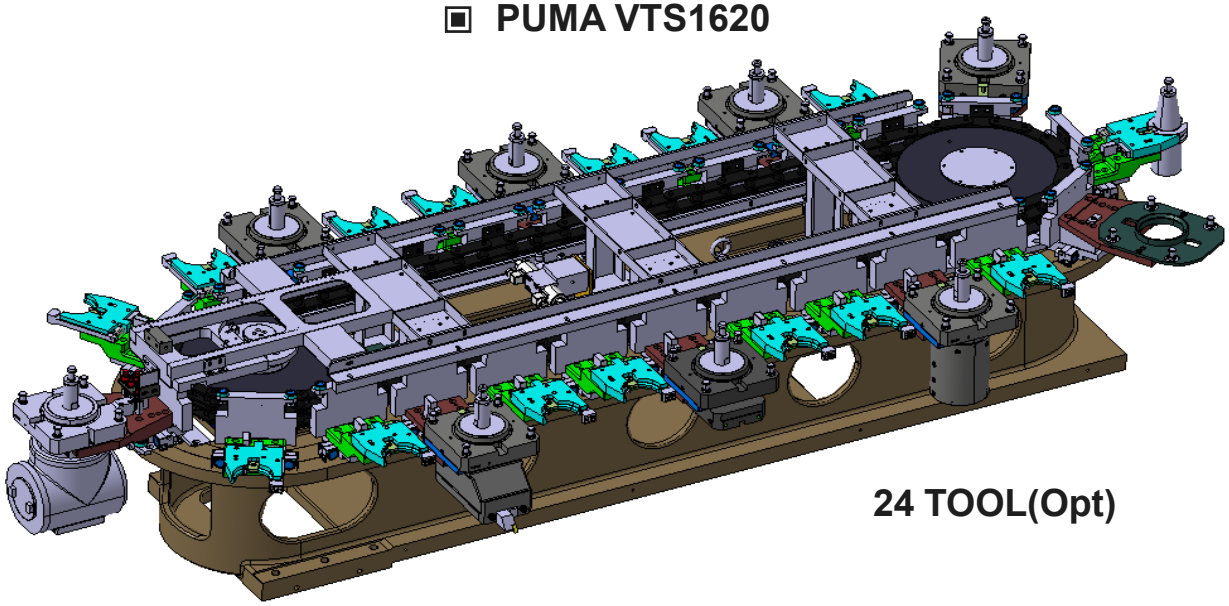
MAGAZINE UNIT

▣ PUMA VTS1620



18 TOOL(Std)

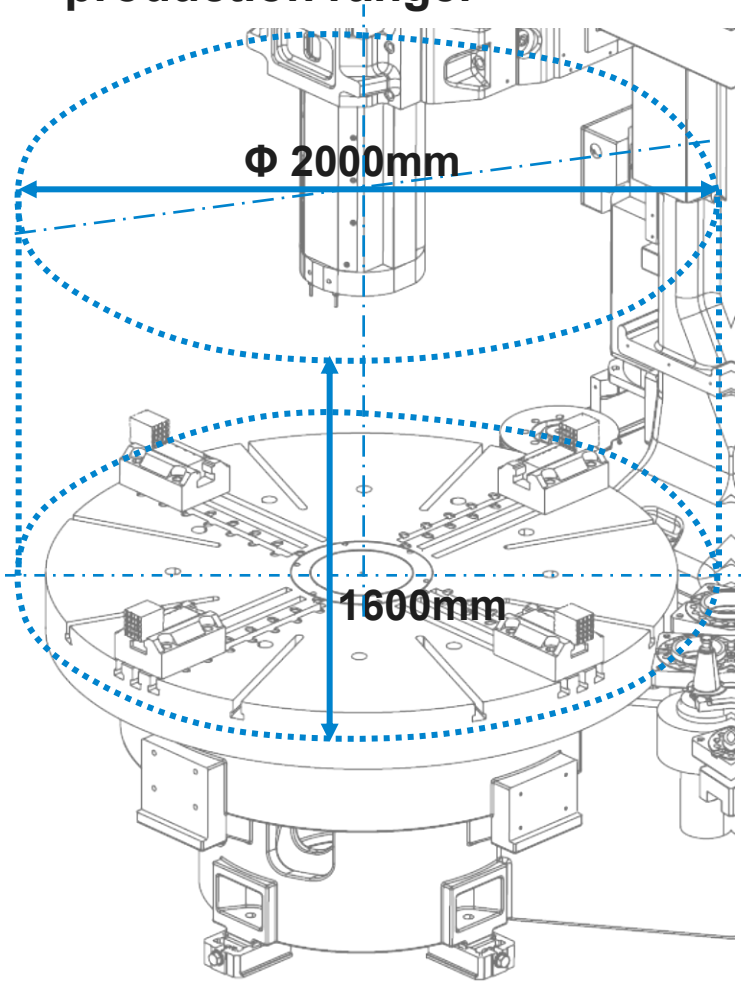
▣ PUMA VTS1620



24 TOOL(Opt)

LARGE WORKING CAPACITY_PUMA VTS1620/M

The cross rail (W axis) can move upon the height of working piece, to increase the efficiency of machining and save the production cost and enlarge the production range.

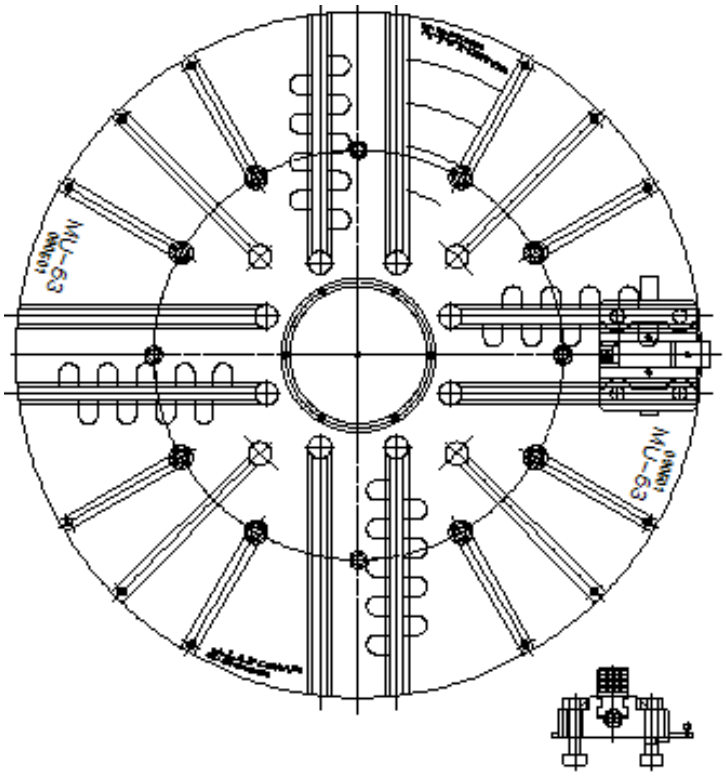


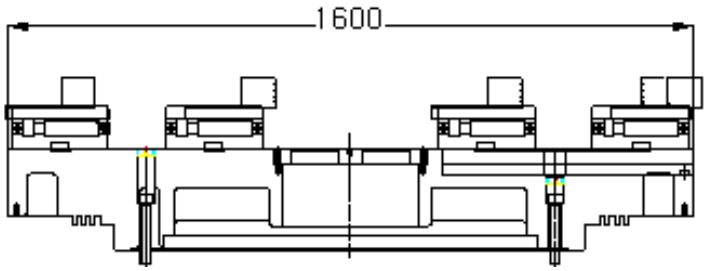
- In the same class of Large vertical turning center, PUMA VTS1620 series have more larger working range and capability than a global competitor.

	Competitor Y-company		Doosan Puma VTS1620M	Improved Rate
Max. turning dia.	Φ1800mm	→	Φ2000mm	10%
Max. turning height	1300mm	→	1600mm	23%
Max. allowable load	8000kg	→	10000kg	20%
Vertical travel of Ram spindle (Z-axis)	900mm	→	960mm	5%
Crossrail travel (W-axis)	800mm	→	800mm	equal
Horizontal travel from table center to tool magazine (+X-axis)	1015mm	→	1600mm	53%

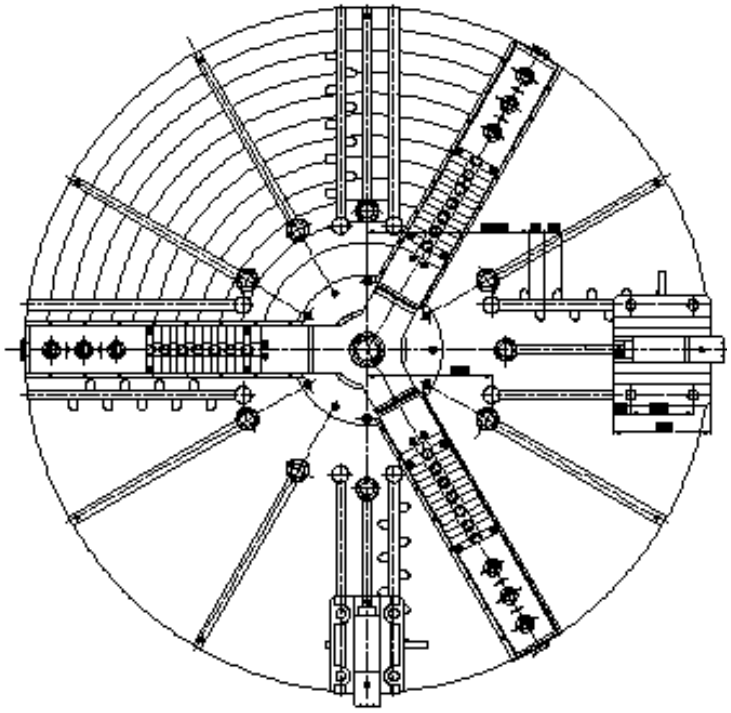
MANUAL CHUCKING_PUMA VTS1620/M

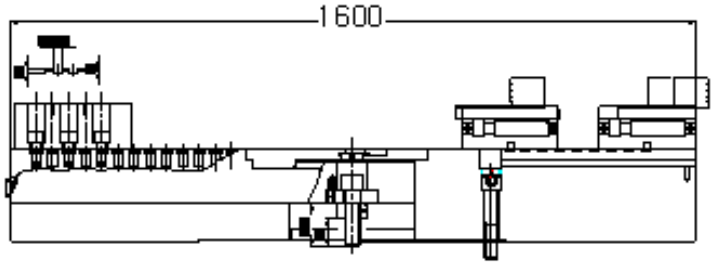
- 63” 4–JAW MANUAL CHUCK





- 63” COMBINATION CHUCK

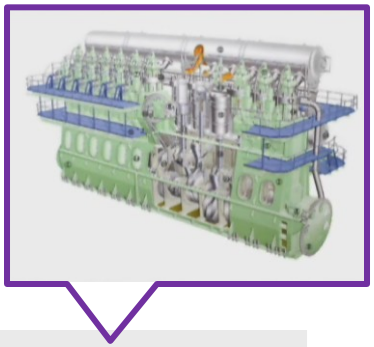




SPECIFICATION COMPARISON WITH COMPETITORS

Manufacturer	Doosan	You-Ji		Toshiba	
Model	**VTS 1620(M)**	**YV 1600ATC**	**VTL 1600ATC**	**TUE 150**	**TMD 16**
Column	Single Step	Single Step	Single Wide	Single Step	Single Wide
Table Diameter	**1600 mm**	1600 mm	1600 mm	1450 mm	1600 mm
Max. Swing	2000 mm	2000 mm	2000 mm	2000 mm	2000 mm
Max. Turning Diameter	**2000 mm**	1800 mm	1800 mm	2000 mm	2000 mm
Max. Turning Height	**1556 mm**	1300 mm	1200/1600/1800 mm	1550 mm	1350 mm
Max. Table Speed	250 r/min	250 r/min	250 r/min	400 r/min	280 r/min
Max. Table Load	**10000 kg**	8000 kg	8000 kg	8000 Kg	10000 Kg
Ram Size	**250mm x 308mm**	220mm x 220mm	250mm x 250mm	250 mm x 230 mm	220 mm x 220 mm
Crossrail Positions	5	N/A	N/A	N/A	N/A
Crossrail Travel	800 mm	750 mm	800/1200/1400 mm	1000 mm	500 mm
X-Axis Travel	-127/1600 mm	-100/1125 mm	-800/1015 mm	-100/1150 mm	-805/1120 mm
Z-Axis Travel	**960 mm**	900 mm	900/1200 mm	900 mm	800 mm
Main Trans. Power	37/45 kW	37 kW	37 kW	37 kW	37 kW
Main Trans. Max. Torque	19875/24380 Nm	19677 Nm	18760/21250 Nm	20930 Nm	21560 Nm
Max. Cutting Force	34556 N	N/A	N/A	25000 N	24000 N
X/Z Rapids	12000 mm/min	12000/10000 mm/min	12000/10000 mm/min	15000/12000 mm/min	12000/8000 mm/min
X/Z Max. Feeds	**5000 mm/min**	2000 mm/min	2000 mm/min	2000 mm/min	2000 mm/min
Crossrail Rapids	N/A	N/A	N/A	300 mm/min	300 mm/min
ATC Positions	18/24	12/16	12/16/24/32/48/60	N/A	N/A
Milling Spindle Power	**15/11 kW**	7.5 kW	7.5 kW	15 kW	11 kW
Milling Spindle Torque	262/687 Nm	N/A	N/A	233 Nm	382 Nm
Milling Spindle Max. Speed	3000/2000 r/min	2400 r/min	2400 r/min	3000 r/min	1500 r/min

PUMA VTS1620M



- **Demo Item**

  Piston Crown

- **Material**

  S17MoS (D990 x 520L)

- **Cutting Condition**

  ID Turning

  - Spindle speed : 80 r/min
  - Feedrate : 0.4 mm/rev

  OD Grooving

  - Spindle speed : 120 r/min
  - Feedrate : 0.1 mm/rev

- **Others**

  SIEMENS Controller , Ram ATC

DOOSAN

E.O.D